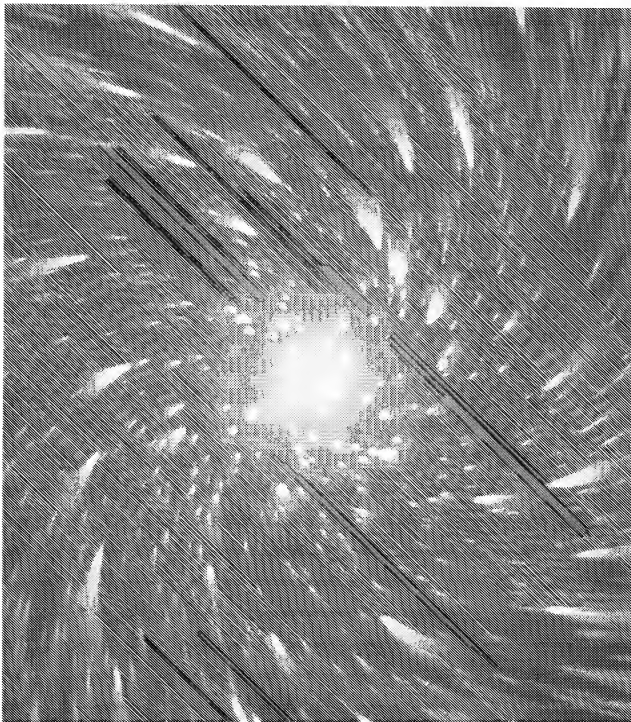
Shin-Etsu

Methylcellulose USP
Hypromellose USP

METOLOSE

Water-Soluble Cellulose Ethers



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Metolose

Preface

Shin-Etsu Chemical Co., Ltd. began to produce water-soluble cellulose ethers in 1962, with the trade name "METOLOSE". "METOLOSE" can be used as a binder for solid dosage forms such as tablets and granules. It also provides a variety of functions such as water retention, thickening, protective colloid, surface activity, sustained release, etc. It is also regarded as a non- digestive fiber.

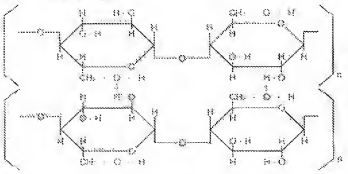
"METOLOSE" consists of Methylcellulose(Methylcellulose USP)and three substitution types of Hydroxypropyl Methylcellulose(Hypromellose USP)each available in several grades differing in viscosity. Highly purified pulp is etherified with chloromethane or with the combination of chloromethane and propylene oxide to form a water soluble, non-ionic cellulose ether.

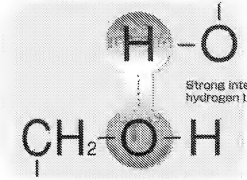
We trust that the information presented in this brochure will be of interest to you. If you have any questions on this information, would like information on our other specially developed pharmaceutical excipients, or if we can be of any further assistance, please do not hesitate to contact us.

What is METOLOSE?

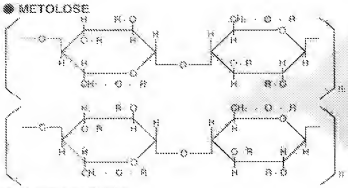
METOLOSE is a nonionic water-soluble cellulose ether which is derived from pulp. To produce METOLOSE, the pulp is first treated with caustic soda to obtain alkali-cellulose, and this is etherified with chloromethane or with the combination of chloromethane and propylene oxide at high temperature. Cellulose is not soluble in water due to its crystalline structure with strong intermolecular hydrogen bondings between OH groups. When the hydrogen atoms of some of the OH groups are substituted with methyl or hydroxypropyl groups, the resulting methoxy and hydroxypropoxy groups interfere with the intermolecular hydrogen bondings, so that the polymer chains are less strongly bound to each other. This allows water to penetrate into the intermolecular spaces of cellulose, and the polymer becomes water-soluble. This is the reason why METOLOSE is soluble in water while pulp, the source of METOLOSE, is not.

● Cellulose (Pulp)

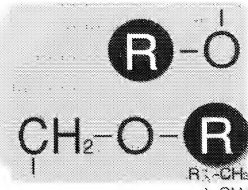




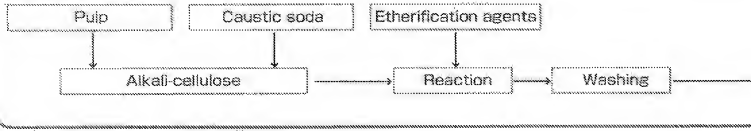
● METOLOSE



R=-CH₃, -CH₂CHOHCH₃ or H



● Production flow diagram



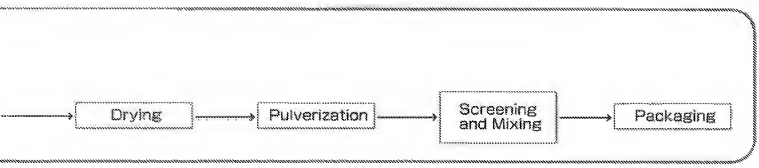
Substitution Types

METOLOSE includes several types with different levels and kinds of substitution.
The available types are SM, 60SH, 65SH, and 90SH. Their substitution levels are shown below.

●Typical substitution level of METOLOSE

Type	Methoxy, D.S.※	Hydroxypropoxy, M.S.※	Name in the USP	CAS registry number
SM	1.8	–	Methylcellulose	9004-67-5
60SH	1.9	0.25	Hypromellose, Substitution type 2910	9004-65-3
65SH	1.8	0.15	Hypromellose, Substitution type 2906	9004-65-3
90SH	1.4	0.20	Hypromellose, Substitution type 2208	9004-65-3

※ D.S.=Degree of substitution i.e. the average number of substituted hydroxyl groups in the anhydrous glucose unit.
M.S.=Molar substitution i.e. the average number of substituents in the anhydrous glucose unit.



General name	Methylcellulose	Hypromellose			Method
Type	SM	60SH	65SH	90SH	
Description and solubility	Conforms				USP
Characters	Conforms				EP
Identification (A-C)	Conforms				USP
Identification (A-F)	Conforms				EP
pH	5.5—8.0				EP
Viscosity	See table below				USP&EP
Loss on drying	Not more than 5.0%				USP
Residue on ignition	Not more than 1.5%				USP
Residue on ignition	Not more than 1.0%				EP
Heavy metals	Within the limit (Not more than 0.001%)				USP
Appearance of solution	Conforms				EP
Chlorides	Within the limit (Not more than 0.5%)				EP
OVI	Conforms※				USP
Methoxy content	27.5—31.5%	28.0—30.0%	27.0—30.0%	19.0—24.0%	USP
Hydroxypropoxy content	----	7.0—12.0%	4.0—7.5%	4.0—12.0%	USP

※ This material does not require OVI testing, under the USP-NF (467) stipulation that "... based on knowledge of the manufacturing process and controlled handling and storage there is no potential for the specific toxic solvents to be present ... if tested, will comply established standards."

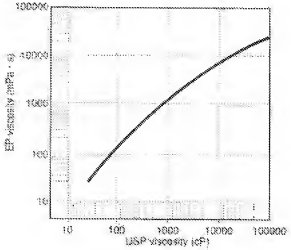
Each type of METOLOSE includes several viscosity grades as shown below.
METOLOSE SR is designed for hydrophilic matrix tablets.
(See separate brochure for information on METOLOSE SR)

● Available grades and viscosity specifications ○: METOLOSE, SR: METOLOSE SR

SM	SH			Labeled Viscosity	USP Specification (cP)※1	EP Specification (mPa・s)※2
	60SH	65SH	90SH			
○				4	3.2—4.8	3.6—5.6
○				15	12.0—18.0	11.3—21.9
○				25	20.0—30.0	18.8—35.0
	○	○		50	40.0—60.0	37.5—70.0
○			○, SR	100	80—120	75—140
○		○	○	400	300—560	300—560
○		○		1500	1125—2100	1125—2100
○	○	○	○, SR	4000	3000—5600	3000—5600
	○			10000	7500—14000	※3
			○, SR	15000	11250—21000	※3
			○, SR	100000	75000—140000	※3

※1 USP viscosity is 80%—120% for labeled viscosity 100 cP and lower.
USP viscosity is 75%—140% for labeled viscosity over 100 cP.
※2 EP viscosity is 75%—140% for all labeled viscosities.
※3 Due to the difference in viscosity measurement method, it is not possible to prepare products meeting both viscosity specifications for labeled viscosities higher than 4000. Please refer to Fig. 1 for the relationship between USP viscosity and EP viscosity.

Figure 1. Relationship between the USP viscosity and the EP viscosity

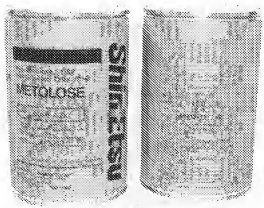


The relationship between the USP viscosity and the EP viscosity is shown in Fig. 1. At a higher viscosity of HPMC there is a larger difference between the USP and the EP viscosities.

Nomenclature

Viscosity type	Viscosity	Others
SM-	15	
60SH-	50	
90SH-	4000	SR

Package



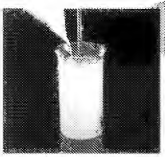
●Package: Double-layered polyethylene bag in fiber drum
●Net weight: 40 kg or 25 kg depending on grade

How to dissolve METOLOSE

The direct addition of METOLOSE to water results in the formation of lumps due to incomplete wetting of the powder. This increases the preparation time. The methods shown below are therefore recommended. The appropriate one should be chosen depending on the application.

1. Hot water method

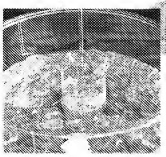
This method takes advantage of the insolubility of METOLOSE in hot water.



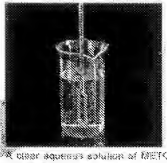
1 Place about 1/2 up to all of the required amount of water at 70℃ or above in a vessel. Gradually add METOLOSE while stirring.

2 At first METOLOSE floats on the surface of the hot water, but it will gradually disperse to form a uniform slurry. Continue stirring and dispersing until all particles are thoroughly wetted in the hot water.

3 Add the remainder of the water as cold water or ice water while stirring.



4 Cool the resultant mixture while stirring until it becomes clarified.



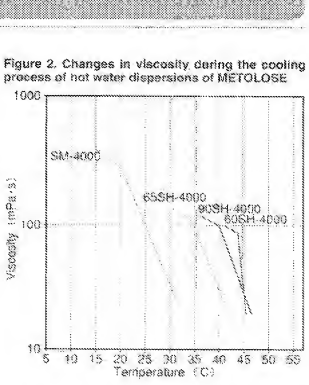
5 A clear aqueous solution of METOLOSE is obtained.

In order to dissolve METOLOSE using the hot water method, sufficient cooling is essential. The temperature at which complete dissolution occurs depends on substitution type. Refer to Fig. 2 and 3 to decide an appropriate cooling temperature.

After METOLOSE has been dispersed in hot water and cooled, the viscosity increases as shown in Fig. 2. The curve has a "bending point" at a certain temperature, which corresponds to the "dissolving temperature."

Test method:
METOLOSE powder and hot water were mixed at the ratio of 10% (weight) and the mixture was cooled while being stirred. The viscosity was measured at various temperatures.

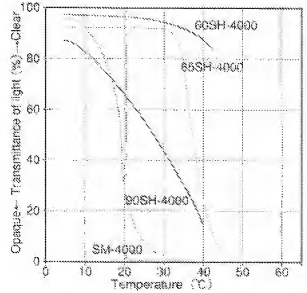
Figure 2. Changes in viscosity during the cooling process of hot water dispersions of METOLOSE



As the METOLOSE dispersion is cooled, its transparency is gradually increased. This behavior is shown in Fig. 3. For applications that require clarity, use a temperature low enough to afford a clear solution, by referring to the figure.

Test method:
METOLOSE powder was dispersed in hot water (2 wt%) and cooled while being stirred. Transmittance of light was measured at various temperatures.

Figure 3. Changes in transparency during the cooling process of hot water dispersions of METOLOSE



2. Organic solvent wetting method

This method can be applied when a hydrophilic solvent, such as alcohol, is used with METOLOSE. Disperse or wet the METOLOSE powder in alcohol or glycol in advance, and then add water while stirring. In this method, cooling is also required. Choose an appropriate temperature by referring to Fig. 2 and 3.

◉ Concentration limits

When preparing a solution, the amount of METOLOSE that can be added is limited because the solution becomes excessively viscous. The following table presents suggested maximum concentrations that can be conveniently handled in general.

Labeled viscosity (cP)	Maximum concentration range (wt %)
100000	2-3
4000-30000	5-10
400-1500	10-15
100 or less	15-20

◉Defoamers

Vigorous stirring of aqueous solutions of METOLOSE sometimes causes foaming. If the solution viscosity is less than 100 mPa·s, the foam will disappear in several hours. To prevent foaming, add one of the defoamers shown below at 0.01-0.05 % based on the solution weight.

[Recommended defoamers※]

General name	Commercial name (manufacturer)
Silicone antifoamer	Shin-Etsu Silicone KM-72 (Shin-Etsu Chemical Co., Ltd.)
Sorbitan sesquioleate	NIKKOL SO-15 (Nikko Chemicals)
Poloxamer 188	Pluronic F68 (BASF)

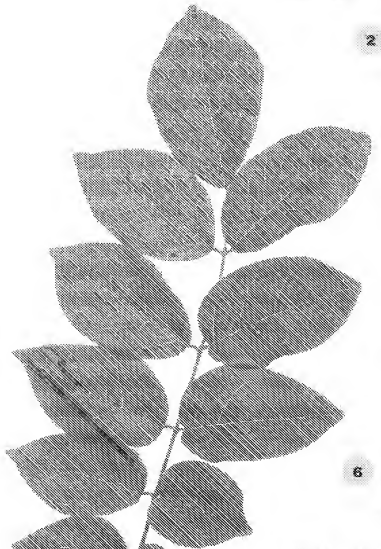
※Refer to local regulations before use.

◉Preservatives※

When a METOLOSE solution is stored for a long period of time, its viscosity may drop or microbial growth may be observed. Addition of sorbic acid as a preservative (0.05-0.1 % based on solution weight) is usually effective in overcoming the problem.

※Refer to local regulations before use.

Characteristics of METOLOSE



1 Odorless and tasteless
METOLOSE is a fibrous or granular powder, white to slightly off-white in color and practically odorless and tasteless.

2 Low ash content
As METOLOSE is a polymeric organic compound, it can be completely combusted under appropriate burning conditions. It can also be effectively purified by washing so its ash content is very low.

3 Water-soluble thickener
Although METOLOSE is insoluble in hot water, it is soluble in cold water giving a transparent viscous solution.

4 Thermal gelation
An aqueous solution of METOLOSE can change to form a precipitate when heated to a certain temperature and reverts to the clear solution after subsequent cooling. The thermal gelation temperature depends on the substitution type, concentration and heating rate.

5 Resistant to salting out
METOLOSE is nonionic and is not a polyelectrolyte. An aqueous solution of METOLOSE is relatively stable in the presence of inorganic salts or organic electrolytes. However, when the concentration of electrolytes exceeds a certain limit, gelation or precipitation may occur.

6 Stable over a wide pH range
The viscosity of METOLOSE solution is hardly affected by acid or alkali, and is stable at pH 3-11. However, the viscosity tends to decrease during prolonged storage of a solution under acidic or alkaline conditions.

7 Soluble in some organic solvents
Owing to the presence of relatively hydrophobic methoxyl and hydroxypropoxyl groups, METOLOSE is soluble in some organic solvents and also in water-organic solvent mixtures.

8 Surface active
An aqueous solution of METOLOSE has a high surface activity and functions as a protective colloid agent and a stabilizer for emulsions, suspensions or foam.

9 Film forming
METOLOSE provides strong, flexible and transparent films with a good barrier property against oils.

Powder properties

METOLOSE is a fibrous or granular powder, white to slightly off-white in color, and practically odorless and tasteless.

Appearance	White or slightly off-white powder, fibrous powder or granules
True density	1.26～1.31 g/mL
Bulk density	0.20-0.45 g/mL
Tapped density	0.35-0.60 g/mL
Angle of repose	35-50°
Degradation temperature	280～300 °C See Fig. 4
Self ignition temperature	approx. 360°C
Hygroscopicity	Depends on substitution type See Fig. 7～9
Dust explosion	Kst=approx 100 bar・m/s See Fig. 5 and 6

*1 bar≒0.1 MPa

Figure 4. Thermogravimetric analysis of 60SH-4000

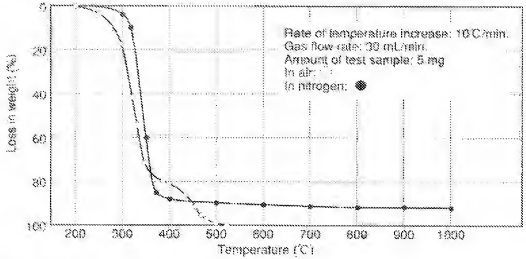
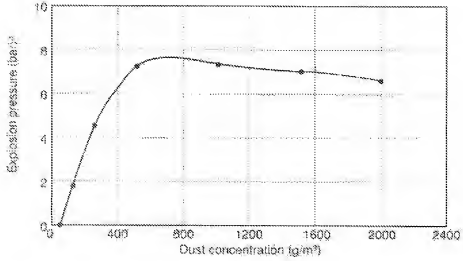
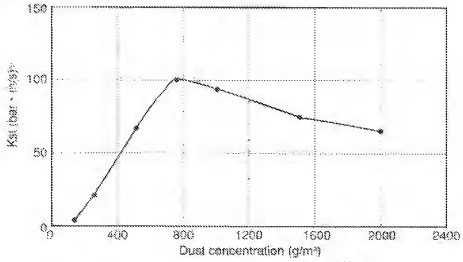


Figure 5. Explosion pressure vs dust concentration



1 bar = 0.1 MPa

Figure 6. Kst vs dust concentration



1 bar = 0.1 MPa

Figure 7. Moisture absorption rate of 60SH-4000

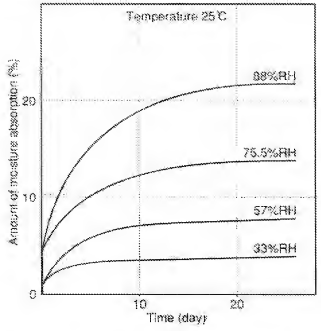


Figure 8. Moisture absorption rate of 90SH-4000

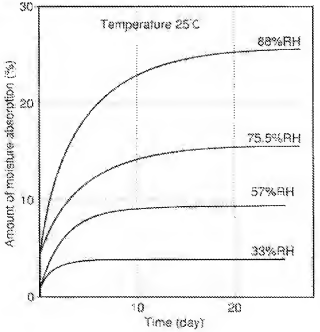
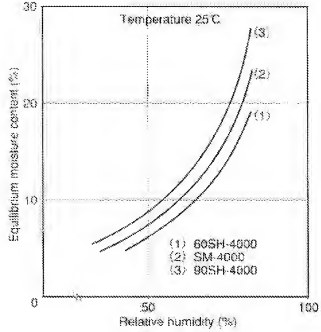


Figure 9. Equilibrium moisture content of METOLOSE



Solution properties

3. Thermal gelation

An aqueous solution of METOLOSE changes to a gel when heated to a certain temperature. This thermal gelation is thought to be due to the formation of a network of polymeric chains via hydrophobic interactions between highly substituted portions, i. e. anhydroglucose units having a degree of substitution of 3. Different substitution types have different gelation behaviors. The gel reverts to its original solution form when it is cooled down. The thermal gelation of METOLOSE has various applications. For more information on the thermal gelation, refer to the article by *Takahashi et al., Japanese Journal of Polymer Science and Technology, Vol. 58, No. 3, p 133-137.*

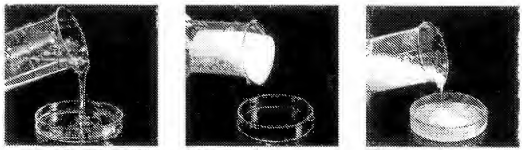
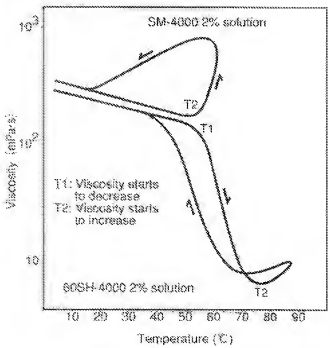


Figure 10. Thermal gelation behavior



Test method:
An aqueous solution of METOLOSE was heated and subsequently cooled at a constant rate. During the heating and cooling, its viscosity was measured using a torsion oscillation viscometer (Rheometry). Heating rate: 1 C/min, cooling rate: 0.5 C/min.

●The thermal gelation temperature and gel texture of METOLOSE

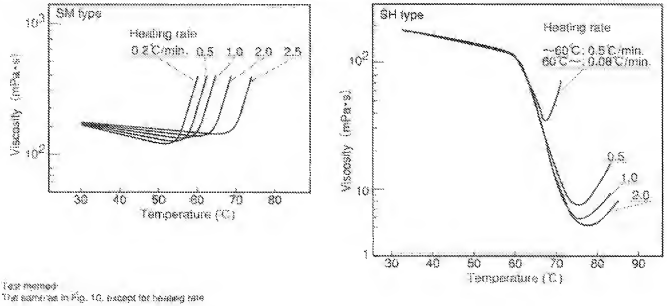
Item / Type		Thermal gelation temperature (℃)		gel texture
		T1	T2	
SM		—	Approx. 55	Hard
SH	60SH	Approx. 55	Approx. 75	Relatively soft
	65SH	Approx. 60	Approx. 75	Relatively soft
	90SH	Approx 70	Approx. 85	Soft

●The effect of additives on the thermal gelation temperature of METOLOSE (2 % aq.)

Type / Added Substance	% Added	SM-4000	60SH-4000		90SH-4000	
		T2	T1	T2	T1	T2
No additive	0	55	55	75	70	85
NaCl	5	40	45	70	60	80
NaOH	5	40	25	45	45	70
Na_2SO_4	5	Salting out	Salting out	Salting out	25	30
$NaCO_3 \cdot 10H_2O$	5	40	30	45	45	80
$Al_2(SO_4)_3 \cdot 18H_2O$	5	45	40	50	50	66
FeCl3	5	50	50	65	65	75
MgCl2	5	55	50	85	60	75
Glucose	5	55	55	75	70	85
Glycerin	5	55	55	75	70	85
Ethanol	5	65	55	80	75	95
Polyethylene glycol	5	55	50	80	70	90

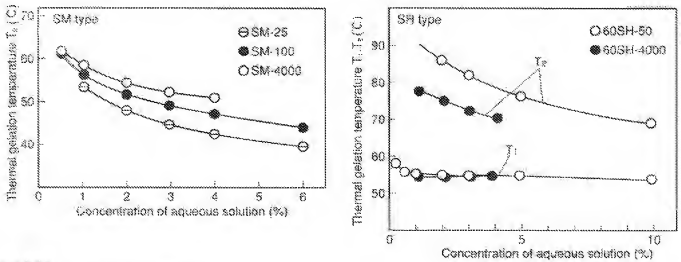
※Weight % based on solution weight.

Figure 11. The effect of heating rate on the thermal gelation temperature (Ref.)



Test method
The same as in Fig. 10, except for heating rate

Figure 12. The effect of concentration and molecular weight on the thermal gel (Ref.)



Test method
The same as in Fig. 10, except for concentration

Ref. Takahashi S. et al., Japanese Journal of Polymer Science and Technology, Vol. 38, No. 3, 133-137

2 Viscosity

The viscosity of solutions of METOLOSE, as well as other water-soluble polymers, is considered to reflect tangling of long polymeric chains in the solution. Therefore, the viscosity of METOLOSE solution is related to molecular weight. The molecular weight of METOLOSE is controlled in the manufacturing process. The following figures show the relationships of viscosity to concentration and temperature.

Figure 13. Concentration/viscosity relationship (20℃)

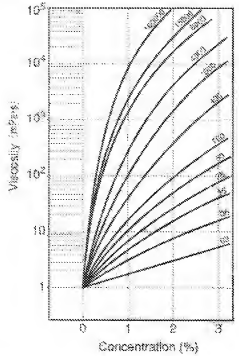


Figure 14. Concentration/viscosity relationship (20℃)

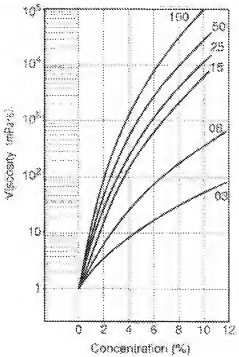
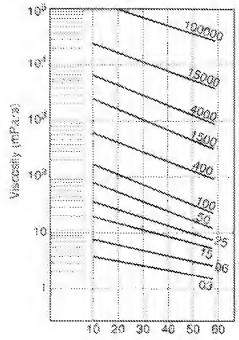


Figure 15. Temperature/viscosity relationship (2 wt.% aqueous solution)



Apparatus : Labeled viscosity of 100000: Ubbelohde-type viscometer
Labeled viscosity of 100 or less: Ubbelohde-type viscometer
Others : Brookfield-type viscometer

Figure 16. Relationship between the viscosity and molecular weight
Method: GPC-MALLS

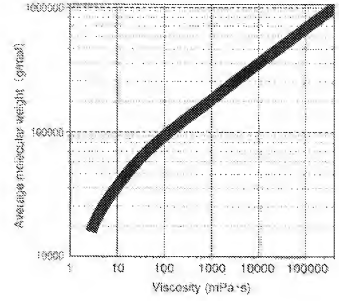
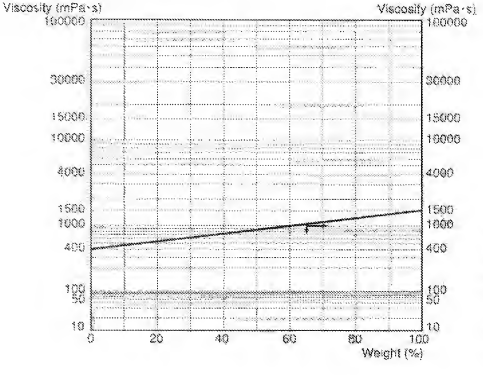


Figure 17. Blending chart for intermediate viscosity

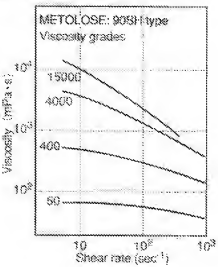


METOLOSE products of different viscosity grades can be blended to obtain an intermediate viscosity grade. It can be seen from Fig. 17, for example, that 35 % of 400 mPa·s and 65 % of 1500 mPa·s would give a 1000 mPa·s product.

3. Rheology

METOLOSE solutions exhibit a non-Newtonian flow, such that the apparent viscosity decreases with increasing shear rate. The non-Newtonian flow is more marked in higher viscosity grades, and at higher concentrations.

Figure 18. Relation between shear rate and apparent viscosity (2 wt.% aqueous solution)



4. Compatibility with electrolytes

METOLOSE has a superior compatibility with electrolytes compared with other ionic polymers. However, if the concentration of electrolyte exceeds a certain limit, METOLOSE will be salted out. The tolerance to electrolytes depends on the substitution type. Generally, METOLOSE with lower substitution levels tends to exhibit a higher tolerance for salting out.

Figure 19. Compatibility between METOLOSE and sodium hydroxide

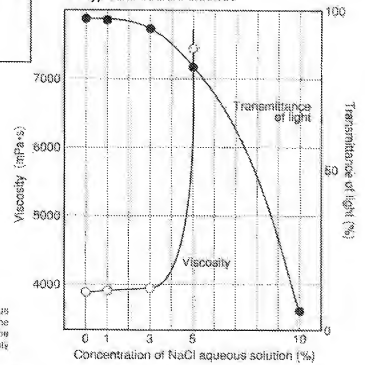
METOLOSE type	METOLOSE concentration	Critical concentration of NaOH (%) 0 5 10 15 20
SM-4000	1%	
65SH-4000	1%	
90SH-4000	1%	

Test method:
METOLOSE solution (2 %) and NaOH solution were mixed in a ratio of 1:1.

Figure 20. Compatibility between METOLOSE and sodium chloride

METOLOSE type	METOLOSE concentration	Critical concentration of NaCl aqueous solution (%) 0 5 10 15 20
SM-4000	0.5%	
65SH-4000	0.5%	
90SH-4000	0.5%	

Figure 21. Compatibility between the METOLOSE SM type and sodium chloride

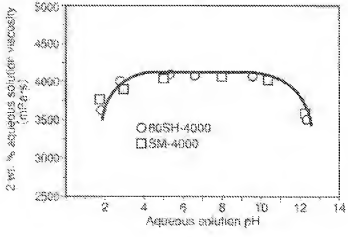


Test method:
METOLOSE SM-4000 was dispersed in hot water containing various amounts of NaCl. The final concentration of METOLOSE was 2 wt %. The dispersion was stirred for 60 minutes at 5 °C to obtain a solution. The solution was then placed in a 25 °C water bath. After 3 hours, the viscosity and transmittance of light were measured.

5. Stability at various pH values

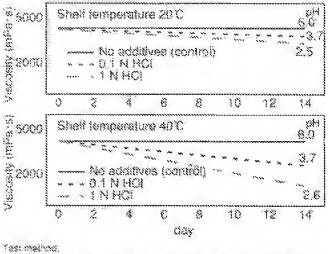
A METOLOSE solution maintains a constant viscosity over the pH range of 3-11. At pH outside of this range, the viscosity will be lower. If a METOLOSE solution is stored at low pH (acidic), its viscosity will be gradually decreased due to depolymerization.

Figure 22. Effect of pH on viscosity



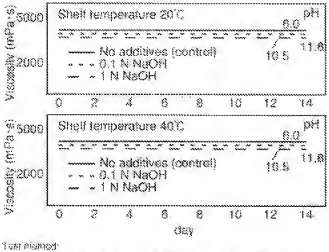
Test method:
A solution was prepared by the hot water method. The pH was adjusted by adding a calculated amount of HCl or NaOH prior to cooling down. Sample concentration: 2 wt%. Viscosity and pH were measured at 20℃.

Figure 23. Viscosity stability to acid



Test method:
The acidic sample solutions were prepared by mixing 0.1 N or 1 N HCl and METOLOSE 90SH-4000 solution (2 %) in a ratio of 100/0.5 by weight. The solutions were stored at 5℃ or 40 ℃. All specimens were clarified. The viscosities were measured at 20 ℃.

Fig. 24. Viscosity stability to alkali

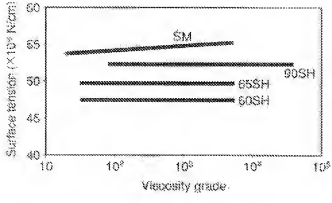


Test method:
The same as in Fig. 23, except that NaOH was used instead of HCl.

8. Surface activity

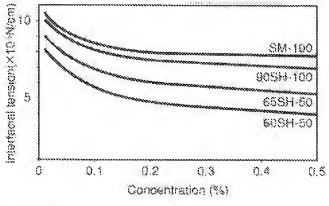
METOLOSE can be considered as a non-ionic surfactant, as it has both hydrophilic and hydrophobic groups in the molecule. Due to such characteristics, it functions as a superior protective colloid, being effective for stabilization of emulsions, suspensions, and foams.

Figure 25. Surface tension of a 0.2 wt.% aqueous solution of METOLOSE



Test method
Ring method Concentration 0.2wt %.

Figure 26. Interfacial tension between an aqueous solution of METOLOSE and dichloroethane



Test method
Ring method

7. Solubility in organic solvents

METOLOSE is a water-soluble polymer and it also dissolves in some organic solvents. Among the substitution types, 60SH has the best solubility in organic solvents.

Typical organic solvents for METOLOSE

Mixture of alcohol and water (See Fig. 27 and 28)

Figure 27. Solubility of 60SH-4000 in methanol

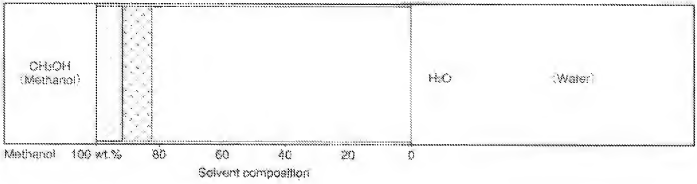
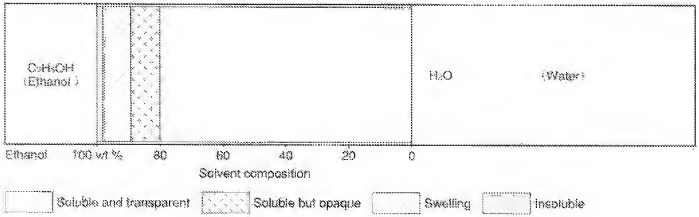


Figure 28. Solubility of 60SH-4000 in ethanol



Test method:
2 g of 60SH-4000 was dispersed or dissolved in 100 mL of solvent mixture at 20°C.

III Film properties

Transparent films are obtained by casting METOLOSE solutions. Although METOLOSE films are relatively rigid, they can be made flexible by adding plasticizers such as glycerin, propylene glycol, sorbitol, and triethyl citrate. The film properties markedly depend on the moisture content.

Figure 29. Tensile strength of METOLOSE film (60SH type, 20°C, 65% RH) MPa=10.2 kg/cm².

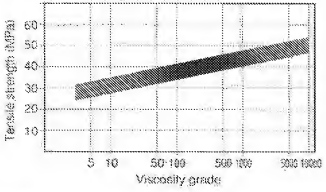


Figure 30. Properties of METOLOSE film

Test sample	SM-4000	60SH-4000	65SH-4000	90SH-4000
Tensile strength (MPa)	54.5	47.6	52.3	50.3
Percent elongation	15.0	11.3	11.0	16.7
Refractive index n_D^{25}	1.495	1.478	1.494	1.494

Test method:
Films were cast on a glass plate. Thickness: 30 μm. Shape: Dumbbell #1. Moisture: approx. 9%. Tensile strength and percent elongation were determined using a Shimadzu Autograph. Load cell: 5 kg, extension speed: 10 mm/min, initial distance between grips: 4 cm.

Applications of METOLOSE

◆ WATER RETENTION ◆

METOLOSE has a water retention property. This characteristic leads to the following functions:

Preventing water loss from, or entry into a base material.

Preventing evaporation of water.

Gel drugs

METOLOSE can be combined with other synthetic polymers or gelatinizing agents to prevent the separation of water or alcohol from a gel drug formulation.

◆ THICKENING ◆

Cataplasms

METOLOSE thickens the base of cataplasms, improving workability.

Suspension drugs

METOLOSE is used as a stabilizer for suspensions of antacid drugs.

◆ OTHERS ◆

Sustained release tablets

Hydrogel-forming property of METOLOSE can be used to delay the release of an active ingredient from tablets. For such "hydrophilic matrix" sustained-release tablets, METOLOSE SR types are typically used.

Dietary supplements

METOLOSE is recognized as a non-digested polymer.

Capsules

METOLOSE is used as a basic component for CELLULOSE capsules.

Application	Suitable grades
Binder for tablets and granules	SM-15, 60SH-50
Sustained release matrix tablets	60SH-50, -4000, 90SH-4000, -4000SR, -100000SR
Gel drugs	60SH-4000, 90SH-4000

Precautions for safe handling

In this section, important precautions for handling METOLOSE are brought to your attention. Before using METOLOSE, be sure to read the "Material Safety Data Sheets (MSDS)" issued by Shin-Etsu for each product; these sheets contain detailed information about safety.

◉ Definitions of symbols

Warning
Error in operation may result in death or severe injury of the user.

Caution
Error in operation may result in minor injury or property damage.

Warning
When a large amount of METOLOSE dust is present in the air, a dust explosion may occur in the presence of flames or electrostatic sparks. (Minimum explosive dust condition: 30 g/m³.) In places where dust may accumulate, utilize local exhaust ventilation systems which are explosion-proof. Dust must be kept away from ignition sources such as fire, or electrostatic sparks.

When handling in large quantities or bulk, avoid accumulation and suspension of dust in the air. Store away from heat sources, sparks and flame. Do not permit grinding, welding, or smoking near this material. General precautions outlined in the National Fire Protection Association's NFPA 654 "Standard for the Prevention of Fire and Dust Explosion from the Manufacturing, Processing, and Handling of Combustible Particulate Solids" and NFPA 77 "Recommended Practice on Static Electricity" are recommended.

Warning
Avoid mixing METOLOSE with peroxides or other oxidizing agents as METOLOSE reacts vigorously with them, and heat or flames may be generated.

Warning
Never use the material in medicine or medical tools that come into contact with human blood, such as medicines given by injection.

Caution
As METOLOSE is easily flammable, take the following points into account.
Keep the material away from heat, sparks and flames. In the event of fire, use water spray, dry chemical powder, or carbon dioxide gas to extinguish it.
When METOLOSE burns, carbon dioxide and some poisonous substances, such as carbon monoxide, methanol, acetaldehyde, formic acid, acrolein, etc. are formed. Use the appropriate protective equipment.
When storing large quantities, comply with local, state, provincial or national regulations.

Caution
As the dust from METOLOSE may cause irritation to the skin, eyes, and throat, use protective glasses, a protective mask, and protective gloves when handling large quantities. In case of eye contact, flush eyes with water thoroughly. In case of skin contact, wash off thoroughly with flowing water or soapy water. If inhaled, immediately move to fresh air and gargle with fresh water. If a large amount of METOLOSE dust is inhaled, and the throat or nose shows signs of abnormality, immediate medical attention should be sought.

Caution

When the material is spilled on a floor and comes in contact with water, the floor will become slippery. Immediately vacuum or sweep up any spill with a disposable cloth.

When an aqueous solution is spilled, wipe it off as thoroughly as possible, then wash the spill site with plenty of water.

Caution

Before using the material in food, cosmetics and pharmaceutical products, make sure that the material is safe for these applications and it has been approved in your local, state, provincial or national regulations governing these applications. Also, make sure that the amount used is within any specified limits in the regulations.

Precautions in Handling

1. Leaving the material in humid places or leaving the package open causes METOLOSE to absorb water that may lead to formation of a large, solid block or to the growth of mold. Avoid exposure to high temperature and humidity, and use it all as soon as possible once the container has been opened.
2. Test the material yourself before using it in order to make sure that it is safe or suitable for your usage.
3. METOLOSE can be disposed of by an approved industrial incineration facility or at an approved landfill. Review your local, state, provincial, or national regulations governing the disposal of waste materials to determine appropriate means of disposal in your area.

Please note:

- The information and data contained herein are believed to be correct and are given in good faith. However, no liability is accepted therefrom, and no warranty or freedom from any patent is to be inferred.
- The general specifications for the products are those in use at the time of printing of this brochure and are subject to change in the future.
- The values appearing in this catalogue do not represent specifications.
- Contents of statements in this catalogue as well as the above statements were written on January 15, 2003.

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